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Formulation and Evaluation of Herbal Shampoo

Navida Parveen[1], Mr. Yogesh Sharma[2]

[1]College of Pharmacy, RIMT University, Mandi Gobindgarh, Punjab, India-147301
[2]Associate Professor, College of Pharmacy, RIMT University, Mandi Gobindgarh, Punjab, India-147301

ABSTRACT

This study aims to formulate and evaluate a herbal shampoo using selected plant-based ingredients known for their hair care benefits. The project emphasizes the utilization of natural resources to develop a chemical-free, eco-friendly, and effective hair cleansing product. Herbal extracts such as reetha, shikakai, hibiscus, aloe vera, neem, and amla were used. The shampoo was evaluated for various physicochemical parameters, including pH, foaming ability, cleansing efficacy, surface tension, dirt dispersion, conditioning performance, viscosity, stability, and microbial load. Results demonstrated that the formulated herbal shampoo meets standard quality benchmarks and offers a natural alternative to commercial chemical-based shampoos.

Keywords:- Herbal Shampoo, Natural Surfactants, Hair Care, Evaluation, Formulation, Plant Extracts.

INTRODUCTION

Hair care products are integral to personal hygiene. Traditional shampoos often contain synthetic detergents, preservatives, and harsh surfactants like sodium lauryl sulfate, and artificial fragrances,which may cause irritation, dryness, or allergic reactions and damage hair and scalp over time. With growing awareness of herbal remedies and side effects of synthetic products, there is increasing interest in developing shampoos with natural plant-based ingredients. Herbal shampoos are safer, biodegradable, and environmentally friendly. This study focuses on the formulation and evaluation of a herbal shampoo using widely recognized plant-based ingredients.

HUMAN HAIR:-Human hair is a keratinized filamentous outgrowth of the skin, primarily made of the protein keratin, which provides strength, elasticity, and resilience. It emerges from the hair follicle, a dynamic mini-organ embedded in the dermis, and extends outward through the epidermis. Although hair appears to be a simple thread-like structure, it is biologically complex and functionally significant.

Structure of Hair:-Hair consists of two main parts:

•Hair Shaft: The visible part above the scalp, which is non-living and made up of dead keratinized cells arranged in three layers:
•Cuticle: The outermost layer composed of flat, overlapping cells like shingles on a roof. It protects the inner structure and reflects light, giving hair its shine.
•Cortex: The thickest layer containing melanin (the pigment responsible for hair color) and fibrous keratin. It determines the strength, texture, and color of the hair.
•Medulla: The innermost, often hollow, core which may or may not be present. It has minimal influence on the physical properties of hair.
•Hair Root: The living part located within the follicle. It includes the hair bulb, which contains the dermal papilla—rich in blood vessels that nourish the growing hair.

2. Hair Growth Cycle
Hair grows in a cyclical pattern consisting of three distinct phases:
•Anagen Phase (Growth Phase): Lasts 2–6 years. Around 85-90% of hair is in this phase at any time. •Catagen Phase (Transitional Phase): Lasts 2–3 weeks. Hair growth ceases and the follicle shrinks. • Telogen Phase (Resting Phase): Lasts about 2–3 months. Old hair sheds and new hair begins to grow.
On average, scalp hair grows about 0.3 to 0.5 mm per day, which equates to roughly 1–1.5 cm per month.

3. Composition and Properties

Hair is composed of:

•Keratin: A fibrous structural protein that is highly resistant to wear and tear.
•Water: Around 10–13%, contributing to hair's flexibility.
•Lipids: Help maintain hair's moisture and shine.
•Pigments: Mainly melanin, determining natural hair color.
•Trace elements: Such as zinc, iron, and copper.

Hair is hygroscopic, meaning it can absorb and retain moisture, and is sensitive to pH changes, chemical exposure, and temperature.

4. Functions of Hair

•Protection: Shields the scalp from ultraviolet rays, minor trauma, and temperature changes.
•Sensory Input: Hair follicles are connected to nerve endings, enhancing tactile sensitivity.
•Aesthetic and Identity Role: Hair plays a crucial role in personal identity, cultural expression, and social interaction.

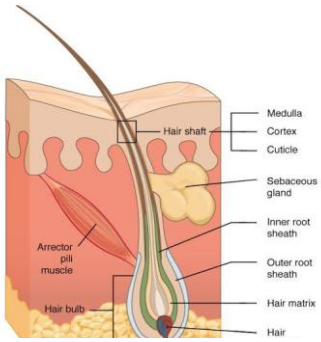

Fig:(1) Structure of human hair

5. Hair and Cosmetic Science

Healthy hair is considered a marker of overall well-being. Therefore, maintaining hair hygiene and structure is central to cosmetic and dermatological sciences. Hair is constantly exposed to environmental pollutants, synthetic chemicals, heat styling, and mechanical stress, which can damage the cuticle and lead to breakage, split ends, and dullness. This underlines the importance of using mild, pH-balanced, and nourishing hair care products—especially herbal shampoos rich in natural bioactives—to support hair strength, shine, and manageability.

SYMPTOMS OF HAIR LOSS:- There are several factors for the hair loss; some of the main factors are given below _

1. Acute illness
2. Autoimmune disorders
3. Chemicals (hair dyes)
4. Chemotherapeutic agents/drugs.
5. Hair loss following childbirth
6. High iron deficiency
7. Diabetes

LITERATURE REVIEW

Numerous studies have shown the efficacy of herbal ingredients in hair care. Reetha (Sapindusmukorossi) contains natural saponins, acting as a surfactant. Shikakai (Acacia concinna) has cleansing and anti-dandruff properties. Hibiscus (Hibiscus rosa-sinensis) is known for its hair growth-stimulating effects.

Aloe vera (Aloe barbadensis) soothes the scalp and adds moisture. Neem (Azadirachtaindica) exhibits antimicrobial activity. Amla (Phyllanthusemblica) is rich in Vitamin C and antioxidants. Prior studies highlight the successful formulation of herbal shampoos with acceptable pH, good foaming ability, and minimal skin irritation.

3.Aims of the study

The present study aims to formulate a herbal shampoo using naturally derived ingredients known for their cleansing, conditioning, and therapeutic properties, and to evaluate its physicochemical and functional attributes in accordance with standardized protocols. The objective is to develop an effective, eco-friendly, and skin-compatible alternative to synthetic shampoos, leveraging the benefits of traditional medicinal plants while ensuring modern quality benchmarks are met.

4. Objectives of the Study

- To formulate a herbal shampoo using selected plant-based ingredients.
- To evaluate the physicochemical properties of the shampoo.
- To assess the cleansing ability, stability, and microbial load of the final product.
- To compare the formulated herbal shampoo with commercial counterparts.
-To determine the surface tension of the shampoo and its relevance to surfactant activity.
-To analyze the conditioning performance on hair strands through subjective and instrumental methods.
-To assess the shelf stability of the shampoo under different environmental conditions.
-To ensure the formulated product is within acceptable dermatological and microbiological safety limits.

MATERIALS AND METHODS

5.1 Selection of Herbal Ingredients

Materials used:-

COLLECTION OF PLANT MATERIALS:

Reetha (Sapindusmukorossi)
Shikakai (Acacia concinna)
Hibiscus (Hibiscus rosa-sinensis)
Aloe vera (Aloe barbadensis)
Neem (Azadirachtaindica)
Amla (Phyllanthusemblica)

REETHA:- . Synonym: Indian soapberry, Washnut
Source: SapindusMukorossi, Family Sapindaceae
Uses:_Cleanser/ insecticide/chemical free cleanser.
-Its antifungal properties help combat dandruff and scalp infections. To remove skin impurities like pimples or eczema, psoriasis, and acne due to its antibacterial and anti-inflammatory effects.

Fig:(2) Reetha

SHIKAKAI:- -It consists of pods of plant Acacia Concinna, Family Mimosacea. It consists of lupeol, spinasterol, lactone natural sugars, hexacosanol, oxalic acid, tartaric acid, citric acid, ascorbic acid, alkaloids and nicotine. It act as natural hair cleanser, astringent and detanglehairs.Itpromotes hair growth, strengthen hairs and act as antidandruff agent.

Fig(2): Shikakai

AMLA:- Promotes hair growth: _Rich in vitamin C, antioxidants, and essential fatty acids, amla nourishes hair follicles and stimulates healthy hair growth and prevents premature graying of hairs.It consist of Tannis, mineral and calcium.

Fig:(3) Amla

HIBISCUS:-It obtained from the fresh petals of Hibiscus Rosa Sinensis belongs to the family malvaceae. It helps to strengthen your hair roots. Hibiscus flowers and leaves are rich in flavonoids and amino acid and also nourishes and thickens your hair.

Fig(4): Hibiscus

ALOE VERA:- Aloe vera is a succulent plant renowned for its therapeutic and cosmetic properties. In the context of hair care, it serves as a multifunctional agent due to its rich composition of vitamins, minerals, enzymes, amino acids, and polysaccharides. Aloe vera is often incorporated as a moisturizing and conditioning agent. It enhances product smoothness, improves viscosity, and provides a soothing feel to the scalp upon application.

Fig(5): Aloe vera

NEEM:-It's obtained from the dried or fresh leaves of Azadirachtaindica of the family Meliaceae. It has a wide range of benefits on both skin and hair, mainly it has anti-inflammatory and anti-fungal properties.

Fig(6): Neem

5.2 Preparation of Extracts

All plant materials were washed, dried, and powdered.
Decoction method was used for aqueous extracts.
Maceration technique was employed using ethanol for certain ingredients.
Extracts were filtered and concentrated using a rotary evaporator.

5.3 Shampoo Formulation Process

Extracts were mixed with distilled water and glycerin.
Natural surfactants like saponin-rich reetha were used.
Essential oils (lavender or tea tree) were added for fragrance and preservation.

The mixture was stirred at controlled temperature to ensure homogenization.

Ingredients Formula

-Reetha extract -10%
-Shikakai extract -5%
-Amla extract -5%
-Aloe vera gel -10%
-Neem extract -2%
-Hibiscus flower – 4-5 flower
-preservative-0.5%
-Distilled water -up to 100%

EVALUATION OF HERBAL SHAMPOO

6.1 Physical Characteristics

Appearance: Brownish, smooth gel-like texture
Odor: Mild herbal scent
Clarity: Opaque

6.2 pH Determination

Measured using pH meter; ideal range: 5.5–6.5

6.3 Foaming and Cleansing Ability

Cylinder shake method used for foam height determination
Dirt dispersion assessed by mixing shampoo with ink and water

6.4 Surface Tension
Du Noüy ring method used to measure the surface tension

6.5 Dirt Dispersion
Less ink retained in foam indicates good cleansing ability

6.6 Conditioning Performance
Evaluated on hair tresses (dry/wet combing test)
Subjective assessment on shine, softness, and manageability

6.7 Viscosity and Stability
Brookfield viscometer used
Stability assessed under different temperature conditions over 4 weeks

6.8 Microbial Load
Total bacterial and fungal count assessed using agar plate method

RESULTS AND DISCUSSION

The formulated herbal shampoo showed acceptable pH (5.8), good foaming (average foam height: 150 mm), excellent cleansing ability, and adequate viscosity. Surface tension was reduced to 32 dynes/cm, indicating effective surfactant action. Dirt dispersion test showed minimal ink retention, suggesting high cleansing performance. Stability testing showed no significant changes under varied temperatures. Microbial load remained within permissible limits. Comparison with commercial shampoos revealed comparable or superior performance in terms of mildness, cleansing, and conditioning. The absence of synthetic additives and presence of bioactive compounds contribute to better scalp health and reduced irritation.

Parameter	Observation
Appearance	Brownish, gel-like
Odor	Mild herbal scent
Clarity	Opaque
Texture	Smooth and consistent
Foam Height (initial)	150 mm
Surface Tension	32 dynes/cm
Viscosity (@20 rpm)	3200 cP
pH	5.8

SAMPLE OF HERBAL SHAMPOO

Fig(7): Sample of herbal shampoo

CONCLUSION

The formulated herbal shampoo using Reetha, Shikakai, hibiscus, aloe vera, neem, and amla is an effective, safe, and eco-friendly alternative to synthetic shampoos. It meets standard quality parameters and is suitable for regular use. Further clinical studies are recommended for large-scale commercialization. In addition to being cost-effective, the herbal formulation leverages traditional knowledge and offers minimal risk of allergic reactions or scalp irritation. With growing consumer preference for natural product, this herbal shampoo holds strong potential for acceptance in both local and global markets.

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Appendices
Graphs:
- Foam Height vs. Time
- pH Stability Over 4 Weeks

Data Tables:
- Table 1: Physical Parameters
- Table 2: pH Readings Across Batches
- Table 3: Viscosity at Various RPMs
- Table 4: Microbial Load

Images:
- Herbal Extracts
- Shampoo Samples
- Testing Apparatus
- Hair Tresses Before and After Application